ABSTRACT

Disclosed are techniques for representing and modeling one or more systems in which each system corresponds to an application mode. This may be done for one or more geometries using local and/or non-local couplings. For each application mode, physical quantities are modeled and may be defined using a graphical user interface. Physical properties may be used to model the physical quantities of each system. The physical properties may be defined in terms of numerical values or constants, and mathematical expressions that may include numerical values, space coordinates, time coordinates, and actual physical quantities. Physical quantities and any associated variables may apply to some or all of a geometric domain, and may also be disabled in other parts of a geometrical domain. Partial differential equations describe the physical quantities. One or more application modes may be combined using an automated technique into a combined system of partial differential equations as a multiphysics model. A portion of the physical quantities and variables associated with the combined system may be selectively solved for. The partial differential equations may be displayed and may in turn solve for the system of partial differential equations in accordance with a general form or a coefficient form. An automated technique provides for automatic derivation of the combined partial differential equations and boundary conditions. This technique automatically merges the equations from a plurality of application modes, and in some instances, performs symbolic differentiation of the equations, producing a single system of partial differential equations. A subset of physical quantities and associated variables not solved for may be used as initial values to the system of partial differential equations.